WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2005CA137G

Title: Model Development for Conjunctive Use Planning and Aquifer Protection in Semi-arid Regions

Project Type: Research

Focus Categories: Nitrate Contamination, Management and Planning, Models

Keywords: Conjunctive planning, Optimization, Model calibration, Inverse problem, Aquifer protection, Genetic algorithm

Start Date: 09/01/2005

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Non-Federal Matching Funds: $98,534

Congressional District: 30

Principal Investigator:
William Yeh

Abstract

Typical of Southern California, the Warren Basin, located in San Bernardino County, has seen sustained population growth and increased water demands since the 1950s. Since groundwater is the only local source of water supply available and as a result of over-pumping, water levels experienced a steady decline of up to 300 ft in some areas between 1956 and 1994. In 1995, the Hi-Desert Water District (HDWD) implemented a recharge program using imported State Water Project (SWP) water. As a consequence, water levels rose up to 200 ft in some areas. However, nitrate concentrations increased drastically, from a baseline level of approximately 10 mg/l to values in excess of 100 mg/l. A study conducted by the USGS showed that the increase in nitrate concentrations is due to entrainment of seepage from septic tanks and irrigation, previously stored in the unsaturated zone, by the artificially elevated water table. There are institutional pressures to remove the contaminated groundwater and to continue raising the groundwater level. The importance of the problem is further evidenced by the ongoing research activities conducted by the USGS. The USGS has collected a large amount of data from the Warren Basin on water level variations and nitrate concentrations, and has developed a preliminary flow and transport simulation model for the Basin.

The overriding goal of this proposal is to develop a decision support system (DSS) for sustainable groundwater management, including conjunctive use of surface water and groundwater as well as aquifer protection. The proposed DSS will encompass a management framework that links the simulation model to an optimization model. Additionally, we will develop algorithms for parameter structure identification, model reliability analysis, data sufficiency evaluation and monitoring network design. Arrangements have been made with Dr. Tracy Nishikawa of the USGS Office in San Diego, California for direct participation in the proposed research, thus maximizing the immediate applicability of the developed methodology.